Abstract of the Disclosure

An active ion-doped waveguide-plasmon resonance (AID WPR) sensor based on plasmon surface resonance (PSR) and an imaging system using the sensor are provided. An additional dielectric thin film doped with active ions and acting as a waveguide is formed on a metal thin film. The active ions are excited by an incident light beam and fluoresce light of a shorter wavelength than the incident light beam through upconversion coupled to surface plasmon resonance, thereby increasing fluorescence intensity variations with respect to incident light angle variations. The AID WPR sensor and the imaging system can detect a minor refractive index variation of a sample, which could not be measured using an existing SPR sensor, or a trace adsorbed material, with 100 times larger refractive index resolution than the existing SPR sensor.